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Repellent efficacy of *Crotalaria burhia* and *Anacardium occidentale* against *Odontotermes obesus* (Isoptera: Termitidae) under laboratory conditions

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ABSTRACT

Laboratory studies were carried out at bioassay lab, Institute of Pesticide Formulation Technology, Gurgaon to incur the repellent efficacy of *Crotalaria burhia* Buch.-Ham and *Anacardium occidentale* L. against *Odontotermes obesus* (Rambur). Aqueous root extracts of *C.burhia* at different concentrations, viz. 0.5%, 1%, 2.5%, 5%, 10% and 20% and powdered leaf dusts of *A. occidentale* at 0.5%, 1%, 2.5%, 5%, 7.5% and 10% concentrations were prepared and tested for their repellent action against *O. obesus*, Chlorpyrifos 20% EC was maintained as standard check. An area of preference test described by Landani *et al.* (1955) and Mc Donald *et al.* (1970) was followed and the results unveiled that root extracts of *C. burhia* at concentration of 10% and 20% gave a mean repellency of 66.66% and 70%, whereas 5% and 7.5% powdered leaf dust of *A. occidentale* gave a mean repellent efficacy of 56.66% and 60%. The lower doses of *C. burhia* and *A. occidentale* were not much effective in repelling away *O. obesus*. The standard check chlorpyrifos 20% EC resulted in 96.66 % and 100% repellency in both the studies. Thus higher doses of root extracts of *C. burhia* and powdered leaf dust of *A. occidentale* can be further tested for their repellent efficacy in field against *O. obesus* and can be included in IPM for termites, as botanicals in IPM are gaining accent as they are environmentally safe.

Key words: *Anacardium occidentale*, *Crotalaria burhia*, *Odontotermes obesus,* Repellency

In the past, the control of termites has been totally based on chemicals especially synthetic insecticides such as persistent organochlorine (OC) and organophosphate (OP) insecticides (Venkateswara *et al*. 2005). The maximum residual effects as well as the development of insecticide resistance in target pests along with adverse effects on human health and concerns for environmental deterioration are some of disadvantages that hindered widespread use of pesticides (Coats 1994). Replacement of synthetic by bio-rational insecticides is a universally acceptable and practical approach worldwide (Logan *et al*. 1990). In this regard, bioactive compounds of plant origin are considered as ecologically safe alternatives. The plant extracts with complex mixtures of such compounds have been investigated for their insecticidal, repellent, and antifeedant properties (Zhu *et al.* 2001, Isman *et al.* 2006). The defense chemicals in plants offer such promise of developing them as insecticides that can be effective against termites in which case these plant chemicals would replace the persistent synthetic insecticides (Ahmed and Qasim 2011).

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Crotolaria burhia Buch-Ham belonging to Leguminaceae is an undershrub, fibrous plant common in the arid regions of West Pakistan, India (Punjab, Rajasthan and Gujarat) and Afghanistan. It is known as Shinio in Rajasthan, its hindi name is Bhip and in Punjabi its known as Bhata and in Gujarat as Ghugato. The genus *Crotolaria* have 300 species worldwide and about 18 species are reported in India. Phytochemical studies have revealed the presence of pyrrolizidine alkaloids as main compounds in this plant. Anticancer, antimicrobial and antibacterial properties have been reported (Kataria *et al.* 2010). Mixture of cow dung + aak (*Calotrips* spp.)+ kheip or khip (*Crotalaria burhia*), local xerophic plant foliage is allowed to rot in a pit for about two months. This mixture (manure) is then applied in chilli and tomato fields for control of root-knot nematodes, termites as well as for good growth (Choudhary and Rajamani 2010).

Anacardium occidentale L. commonly known as cashew belongs to Anacardiaceae family, native of Brazil and have great economic and medicinal value. Laboratory studies conducted by Ileke (2012) revealed that the powders and oils extracts of *A. occidentale* seeds proved effective against the cowpea bruchid, *Callosobruchus maculatus* (Fab.) in cowpea seeds. Research studies revealed that Cashew Nut Shell Liquid (CNSL) and leaf extracts of *A. occidentale* effectively repelled termites in Nigeria

(Osipitami and Oseyemi 2012).

In this regard the present study was undertaken to incur the repellent efficacy of *C. burhia* and *A. occidentale* against *Odontotermes obesus* (Rambur).

MATERIALS AND METHODS

Roots of *C.burhia* were collected from Bikaner, Rajasthan and then sun dried to remove the moisture content in roots. The roots are then hammered well and the hammered roots are collected in a tray. Different concentrations of root extracts, viz. 0.5%, 1%, 2.5%, 5%, 10% and 20% were prepared by dissolving 0.5, 1, 2.5, 5, 10 and 20 gm of root powder in 100 ml of water. The supernatant were filtered after 24 hr and used for testing their repellency against *O. obesus*.

Cashew leaves collected from Agricultural College and Research Institute, Killikulam, Tamil Nadu were air dried till the leaves are devoid of moisture. The dried leaves are crushed and then powdered using mixer. Different concentrations of leaf dust, viz. 0.5%, 1%, 2.5%, 5%, 7.5% and 10% were prepared by mixing determined amount of powdered leaf with china clay, which acts as a carrier material.

The methodology followed by Landani *et al*. (1955) and Mc Donalad *et al*. (1970) was followed and the aim of this trial was to determine the repellent efficacy of *C. burhia* and *A. occidentale* against *O. obesus*. Aqueous root extracts of *C. burhia* at different concentrations, viz. 0.5%, 1%, 2.5%, 5%, 10% and 20% and powdered leaf dusts of *A. occidentale* at 0.5%, 1%, 2.5%, 5%, 7.5% and 10% concentration prepared were tested for their repellent efficacy. Whatman filter papers (No. 1) were divided into two parts so that when they were placed in the Petri dishes (9 cm in diameter), 2 cm space was created between them. Half of the papers were treated with 1 ml of various concentrations of *C.burhia* and the other half of the papers were treated with water and then placed in the outdoors for the papers to be dried (Fig 1). Doses of powdered *A. occidentale* (2 gm of respective concentrations) were evenly spread over one half of the filter paper and the other half treated with water and then air dried. Ten termites (workers and soldiers) were released separately into center of each filter paper in the Petri dish using a very fine brush and with utmost care. The Petri plates were then covered with black cloth and placed in BOD at temperature of 26 degree Celsius and at 70% RH. The experiment was laid out in CRBD and each treatment was replicated thrice. The number of termites present on control and treatment halves were recorded after 1 hr exposure.

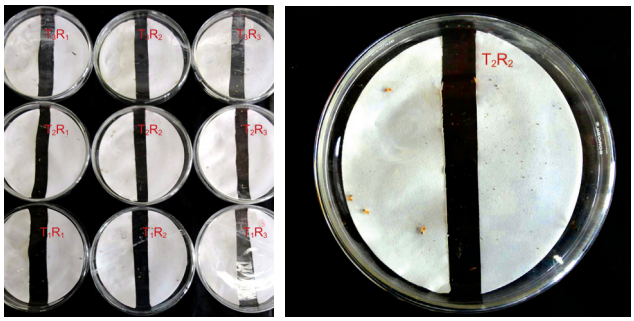

Fig 1 Area of Preference study for repellent efficacy of *C.burhia* against *O.obesus*

Table 1 Mean repellent efficacy of *C.burhia* and *A.occidentale* against *O.obesus*

Treatment	Concentration	*Repellency (%)	Concentration	*Repellency (%)
T_1	*C. burhia* 0.5%	6.67 (14.96)^{d}	*A. occidentale* 0.5%	6.67 (14.96)^{d}
T_2	*C. burhia* 1%	16.67 (24.09)^{cd}	*A. occidentale* 1%	10.00 (18.43)^{d}
T_3	*C. burhia* 2.5%	26.67 (31.09)^{c}	*A. occidentale* 2.5%	23.33 (28.88)^{c}
T_4	*C. burhia* 5%	36.67 (37.27)^{c}	*A. occidentale* 5%	26.67 (31.09)^{c}
T_5	*C. burhia* 10%	66.67 (54.74)^{b}	*A. occidentale* 10%	56.67 (48.83)^{d}
T_6	*C. burhia* 20%	70.00 (56.79)^{b}	*A. occidentale* 20%	60.00 (50.77)^{b}
T_7	Chlorpyrifos 20 EC	96.67 (79.48)^{a}	Chlorpyrifos 500 EC	100.00 (90.00)^{a}

*Mean of three replications. In a column means followed by a common letter are not significantly different at P = 0.05 by LSD. Figures in parentheses are arcsine √ Per cent transformed values.

RESULTS AND DISCUSSION

C. burhia root extract

Results revealed that root extracts of *C.burhia* at concentration of 10% and 20% were on par with each other and gave an effective mean repellency of 66.67% and 70%, whereas lower doses of *C. burhia,* viz. 0.5%, 1%, 2.5% and 5% recorded efficacy of less than forty per cent. Standard check chlorpyrifos 20 EC recorded highest repellency of 96.6% and was very effective.

A. occidentale leaf dust

Results admitted that 5% and 7.5% powdered leaf dust of *A. occidentale* gave a mean repellent efficacy of 56.67% and 60% and were on par with each other which proved their repellent efficacy against *O. obesus*. The lower doses of *A. occidentale* were not effective in repelling away *O. obesus* as they recorded a mere 6.6%, 10%, 23.3% and 26.6% for 1%, 2.5%, 5% and 7.5% concentrations respectively. The standard check chlorpyrifos 20% EC resulted 100% repellency and this study falls in line with the findings of Osipitami and Oseyemi (2012) where *A. occidentale* recorded 60% repellency against *Macrotermes* spp.

It was concluded that root extracts of *C. burhia* @ 10% and 20% proved its efficacy in driving away *O. obesus* and powdered leaf dust of *A. occidentale* @ 5% and 7.5% was also found to repel more than 50% of *O. obesus* which concludes that they can be further tested for their repellent

efficacy in field against *O. obesus* and can be included in IPM for termites, as botanicals in IPM are gaining accent as they are ecologically safer.

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